Amendments To The Claims.

1. (Currently Amended) Gradient tensor induction magnetic field measuring apparatus for measuring ~~the~~ a gradient tensor induction magnetic signal of ~~the~~ a transient magnetic field in a ~~borehole~~ wellbore to be used to determine ~~the~~ a conductivity gradient of ~~the~~ an anisotropic earth formations penetrated by ~~a~~ the wellbore, the apparatus comprising e, f and any or any combination of a)-d), wherein:

   a) at least one transmitter coil and a pair of closely located parallel tri-axial EM induction receivers, each formed by three mutually orthogonal receiver coils, separated by a small vector, $\Delta \boldsymbol{r}$, wherein ~~the~~ a distance between the two parallel tri-axial EM induction receivers is much smaller than ~~the~~ a distance L between the transmitter and ~~the~~ a center of the vector $\Delta \boldsymbol{r}$, connecting the two ~~receivers: $\Delta \boldsymbol{r} \ll L$, in order that the~~ receivers, wherein conditions are fulfilled that the gradients are measured of ~~the~~ different components of the magnetic field induced in the earth formation;

   b) at least one receiver coil and a pair of closely located parallel tri-axial EM induction transmitter coils, separated by a small vector, $\Delta \boldsymbol{r}$, wherein ~~the~~ a distance between the two parallel tri-axial EM induction transmitters is much smaller than ~~the~~ a distance L between the receiver and ~~the~~ a center of the vector $\Delta \boldsymbol{r}$, connecting the two ~~transmitters: $\Delta \boldsymbol{r} \ll L$, in order that the~~ transmitters, wherein conditions are fulfilled, based on ~~the~~ a reciprocity principal, that ~~the~~ gradients are measured of ~~the~~ different components of the magnetic field induced in the earth formation;

   c) a tri-axial EM induction transmitter formed by three mutually orthogonal transmitter coils, and a pair of closely located tri-axial EM induction receivers, each formed by

three mutually orthogonal receiver coils, separated by a small vector, $\Delta \boldsymbol{r}$, wherein ~~the~~ a distance between the two tri-axial EM induction receivers is much smaller than ~~the~~ a distance L between the tri-axial transmitter and ~~the~~ a center of the $\Delta \boldsymbol{r}$, ~~$\Delta \boldsymbol{r} << L$, in order that the~~ wherein conditions are fulfilled that ~~the~~ gradients are measured of ~~the~~ different components of the induction tensor formed by the magnetic fields induced in the earth formation;

d) a pair of closely located tri-axial EM induction transmitters, separated by a small vector, $\Delta \boldsymbol{r}$, and a tri-axial EM induction receiver, wherein ~~the~~ a distance between two tri-axial EM induction transmitters is much smaller than the distance L between the tri-axial receiver and the center of the vector $\Delta \boldsymbol{r}$, ~~$\Delta \boldsymbol{r} << L$, in order that the~~ wherein conditions are fulfilled, based on ~~the~~ a reciprocity principal, ~~that the~~ gradients are measured of ~~the~~ different components of the induction tensor formed by the magnetic fields induced in the earth formation; and

e) means for receiving voltages induced in said receiver coils;

f) means for measuring a difference between the said voltages in the different pairs of the receivers, or due to the different pairs of the transmitters.

2. (Currently Amended) The apparatus as defined in claim 1 further comprising:

a) a tri-axial transmitter array and three pairs of receiver coils, measuring ~~the~~ $\partial H_z^\beta / \partial x$, $\partial H_x^\beta / \partial z$, and $\partial H_y^\beta / \partial x$ ($\beta = x, y, z$) components;

b) a tri-axial transmitter array and three pairs of receiver coils, measuring ~~the~~ $\partial H_z^\beta / \partial z$, $\partial H_x^\beta / \partial z$, and $\partial H_y^\beta / \partial z$ ($\beta = x, y, z$) components;

c) a tri-axial transmitter array and up to 27 pairs of receiver coils, measuring some or all components~~:~~ <u>of</u> $\partial H_{\alpha}^{\beta} / \partial \gamma (\alpha, \beta, \gamma = x, y, z)$;

d) three mutually orthogonal transmitter coils, displaced along ~~the~~ <u>a</u> z-axis and oriented in ~~the~~ x-, y-, and z- directions, and three pairs of receiver coils, measuring ~~the~~ $\partial H_{z}^{\beta} / \partial x$, $\partial H_{x}^{\beta} / \partial z$, and $\partial H_{y}^{\beta} / \partial x$ $(\beta = x, y, z)$ components;

e) three mutually orthogonal transmitter coils, displaced along ~~the~~ z-axis and oriented in the x-, y-, and z- directions, and three pairs of receiver coils, measuring ~~the~~ $\partial H_{z}^{\beta} / \partial z$, $\partial H_{x}^{\beta} / \partial z$, and $\partial H_{y}^{\beta} / \partial z$ $(\beta = x, y, z)$ components;

f) three mutually orthogonal transmitter coils, displaced along ~~the~~ z-axis and oriented in the x-, y-, and z- directions, and up to 27 pairs of receiver coils, measuring some or all ~~components:~~ <u>components of</u> $\partial H_{\alpha}^{\beta} / \partial \gamma (\alpha, \beta, \gamma = x, y, z)$.

3. (Currently Amended) A method for measuring ~~the~~ conductivity of ~~the~~ <u>an</u> anisotropic earth formations penetrated by a wellbore, <u>the method</u> comprising:

a) measuring a gradient of magnetic field between two closely positioned parallel receiver coils, wherein ~~the~~ <u>a</u> harmonic (frequency domain) electromagnetic field is generated by at least one transmitter coil, and the receiver coils are separated by a small vector, $\Delta \mathbf{r}$, with ~~the~~ <u>a</u> magnetic moment direction of the transmitter coil parallel or different from ~~the~~ <u>a</u> magnetic moment direction of the receiver coils, wherein ~~the~~ <u>a</u> distance between two parallel receiver coils being much smaller than ~~the~~ <u>a</u> distance L between the transmitter and ~~the~~ <u>a</u> center of the vector $\Delta \mathbf{r}$, connecting two receivers,

~~$|\Delta\mathbf{r}| \ll L$, to ensure that~~ and the receiver pair measures the gradient of the induction magnetic field;

b) ~~using said gradient electromagnetic induction logging instrument for~~ obtaining a plurality of measurements for different positions ~~of the instrument~~ along the ~~borehole;~~ wellbore;

c) obtaining from ~~the~~ said plurality of measurements ~~the~~ a horizontal and vertical conductivities of ~~the~~ a medium, and ~~the~~ a relative dip angle of the formation by inverting the gradient electromagnetic induction data using a model of a layered anisotropic formation and regularization methods of inverse problem solution.

4. (Currently Amended) The method of claim **3**, ~~wherein the~~ further comprising generating a frequency domain current in the transmitter ~~is generated~~ for at least several frequencies, and the receivers measure ~~the~~ a signal at several frequencies, wherein ~~the~~ multi-frequency gradient measurements are used for frequency gradient EM sounding of the medium at different distances from the wellbore to produce a volume image of ~~the~~ anisotropic conductivity distribution around the borehole.

5. (Currently Amended) A method for measuring ~~the~~ conductivity of ~~the~~ an anisotropic earth formations penetrated by a wellbore, ~~wherein~~ the method ~~comprises:~~ comprising:

a) measuring a gradient of a magnetic field at ~~the~~ a receiver coil position, wherein ~~the~~ a harmonic (frequency domain) or pulse (time domain) electromagnetic field is generated by two closely positioned parallel transmitter coils, separated by a small vector, $\Delta\mathbf{r}$, with ~~the~~ a magnetic moment direction of the transmitters parallel or

different from ~~the~~ a magnetic moment direction of the receiver, wherein two transmitters generate successively a harmonic (frequency domain) primary EM field which propagates through the anisotropic formation, surrounding the ~~borehole.~~ wellbore;

b) ~~using said gradient electromagnetic induction logging instrument for~~ obtaining a plurality of measurements for different positions ~~of the instrument~~ along the ~~borehole;~~ wellbore;

c) obtaining from ~~the~~ said plurality of measurements ~~the~~ a horizontal and vertical conductivities of ~~the~~ a medium and ~~the~~ a relative dip angle of the formation by inverting ~~the~~ gradient electromagnetic induction data, using a model of layered anisotropic formation and regularization methods of ~~the~~ an inverse problem solution.

6. (Currently Amended) The method of claim **5**, ~~wherein the~~ further comprising generating a frequency domain current in the transmitter ~~is generated~~ for at least several frequencies, and the receivers measure ~~the~~ a signal at several frequencies, wherein ~~the~~ multi-frequency gradient measurements are used for frequency gradient EM sounding of the medium at different distances from the wellbore to produce a volume image of ~~the~~ an anisotropic conductivity distribution around the ~~borehole.~~ wellbore.

7. (Currently Amended) A method for measuring ~~the~~ conductivity of ~~the~~ an anisotropic earth formations penetrated by a wellbore, ~~wherein~~ the method ~~comprises:~~ comprising:

a) conveying an electromagnetic logging instrument into a ~~borehole,~~ wellbore, said logging instrument including a tri-axial EM induction transmitter and a pair of

closely located tri-axial EM induction receivers, separated by a small vector, $\Delta\mathbf{r}$, wherein one set of tri-axial receivers detects three components of the magnetic field due to each of three transmitters for a total of nine signals forming an induction tensor;

b) said logging instrument measuring a gradient in the direction $\Delta\mathbf{r}$ of each of three components of the magnetic field in the receivers due to each of three transmitters for a total of nine gradient signals forming a gradient ~~tensor.~~ tensor;

c) using said ~~gradient tensor induction well~~ logging ~~(GTIWL)~~ instrument for obtaining a plurality of measurements for the different positions of the instrument along the ~~borehole;~~ wellbore;

d) obtaining from ~~the~~ said plurality of measurements ~~the~~ horizontal and vertical conductivities of ~~the~~ a medium and ~~the~~ a relative dip angle of the formation by inverting ~~the~~ gradient tensor induction well logging ~~(GTIWL)~~ data using a model of layered anisotropic formation and regularization methods for ~~the~~ an inverse problem solution.

8. (Currently Amended) The method of claim **7**, ~~wherein the~~ further comprising generating a frequency domain current in the tri-axial transmitter ~~is generated~~ for at least several frequencies, and the tri-axial receivers measure ~~the~~ a signal at several frequencies, wherein ~~the~~ a multi-frequency measurements are combined in ~~the~~ a gradient tensor induction signal to be used for frequency gradient EM sounding of the medium at different distances from the wellbore to produce a volume image of ~~the~~ anisotropic conductivity distribution around the ~~borehole.~~ wellbore.

9. (Currently Amended) A method for measuring ~~the~~ conductivity of ~~the~~ an anisotropic earth formations penetrated by a wellbore, ~~wherein~~ the method ~~comprises:~~ comprising:

a) conveying an electromagnetic logging instrument into ~~a borehole,~~ the wellbore, said logging instrument including a pair of closely located tri-axial EM induction transmitters, separated by a small vector, $\Delta \mathbf{r}$, and a tri-axial EM induction receiver, wherein a set of tri-axial receivers detects three components of ~~the~~ a magnetic field due to each of the three transmitters for a total of nine signals forming an induction tensor;

b) measuring by the said logging instrument a gradient in the direction $\Delta \mathbf{r}$ of each of the three components of the magnetic field in the tri-axial receiver for a total of nine gradient signals forming a gradient ~~tensor.~~ tensor;

c) using said ~~gradient tensor induction well~~ logging ~~(GTIWL)~~ instrument for obtaining a plurality of measurements for ~~the~~ different positions of the instrument along the ~~borehole;~~ wellbore;

d) obtaining from ~~the~~ said plurality of measurements ~~the~~ horizontal and vertical conductivities of ~~the~~ a medium and ~~the~~ a relative dip angle of the formation by inverting ~~the gradient tensor induction~~ well logging ~~(GTIWL)~~ data using a model of layered anisotropic formation and regularization methods for ~~the~~ an inverse problem solution.

10. (Currently Amended) The method of claim **9**, ~~wherein the~~ further comprising generating a frequency domain current in the tri-axial transmitters ~~is generated~~ for at least several frequencies, and the tri-axial receivers measure ~~the~~ a signal at several frequencies, wherein

~~the~~ multi- frequency measurements are combined in ~~the~~ a gradient tensor induction signal to be used for frequency gradient EM sounding of the medium at different distances from the wellbore to produce a volume image of ~~the~~ anisotropic conductivity distribution around the ~~borehole.~~ wellbore.